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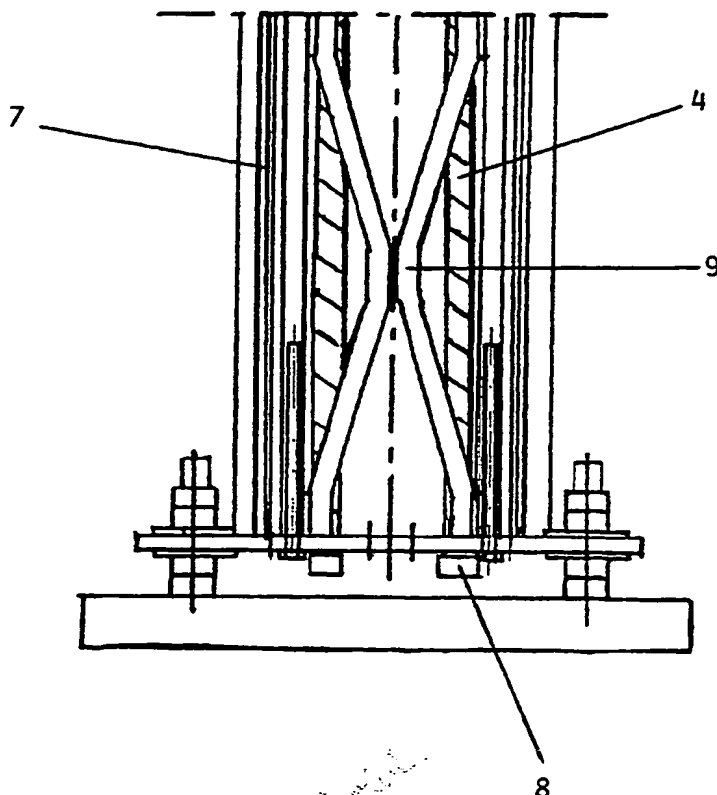
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[Continued on next page]

(54) Title: MAST



(57) Abstract: This invention relates to a mast for traffic information and/or lighting purposes, such as traffic signposts, light signal posts, full and half gantries, street lighting purposes or similar. The mast comprises a fastening profile having gripping members being adapted for cooperation with corresponding gripping members on a mast profile being included in the mast, and a reinforcement member which at least is enclosed in part by the fastening profile. The mast profile and the fastening profile are adapted for cooperation by means of friction effect/retaining.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

MAST

This invention relates to a mast for traffic information or lighting purposes, such as traffic signposts, light signal posts, full and half gantries, street lighting posts or similar. The invention shows a mast which possess both resilient and energy absorbing properties in the case of a collision or another major, mechanical impact. Furthermore, the ability of the mast to absorbing energy can be dimensioned according to requirements.

10 Background of the invention

Utilizing resilient masts is important for the road safety. The seriousness which an accident involving a vehicle poses to persons being inside the vehicle, can be influenced by the behaviour of supporting structures for traffic equipment when being under impact. Based on safety assessments, supporting structures for traffic equipment are made to break or yield in the case of a collision.

For a long time there has been a need for standards in respect of the functionality and the testing of such supporting structures, and a European standard (EN 12767) for this purpose was adopted in April 2000. The standard concerns three safety categories of supporting structures:

- high energy absorbing masts (HE masts),
- low energy absorbing masts (LE masts) and
- 25 - non energy absorbing masts (NE masts).

Figure 1 shows principle and mode of operation for a non energy absorbing mast (NE mast). At a collision, the non energy absorbing mast will be squeezed together, bend and be released at the bottom. This is generally achieved by means of a rupture joint. Thereafter, the non energy absorbing mast is conveyed over and behind the vehicle. The NE-mast does not absorb energy, and the velocity of the vehicle is not reduced.

Low energy absorbing masts (LE-masts) and high energy absorbing masts (HE masts) which in particular are suitable for use in town and suburban areas, where there may be a danger of vehicles hitting cyclists and pedestrians if non

energy absorbing masts are used.

HE masts are constructed so that they stop a vehicle at a collision. As opposed to the NE masts, HE masts are not broken off at a collision with a vehicle. The reason for
5 dividing essentially between HE-masts and LE-masts is that different resistances are provided when a vehicle collides with a mast. HE and LE masts are constructed with different abilities to absorb energy. The reason for this is that a certain allowed maximum limit for the mentioned resistance
10 is determined in European standard EN 12767, in order to reduce the danger of injuries to persons being in the vehicle.

When colliding with a HE or LE mast, the mast is squeezed together and bends in front of the vehicle during
15 the complete collision incident. Simultaneously, the vehicle is retained. In the case of HE masts, the vehicle is completely stopped, while in the case of LE masts, the vehicle continues onwards with reduced velocity. The shorter a mast, the more resistance will have to be exerted by the
20 mast on the vehicle in order to stop it in the case of a collision. For this reason, HE masts are rather more suitable for tall masts, above approx. 6 m, e.g. lighting masts.

On the other hand, the LE-mast is designed to reduce
25 the velocity of the vehicle in part before breaking off and letting the vehicle continue onwards. For this reason, such masts are in particular suitable, e.g. for short signposts and light signal posts in towns and villages. Figure 2A shows principle and mode of operation of a LE mast at a
30 collision between a vehicle and a LE mast, and figure 2B shows principle and mode of operation for a HE mast at a collision between a vehicle and a HE mast.

Prior art

The invention according to NO 160458 relates to a post
35 comprising a casing and bars adapted for static cooperation with each other and connected to each other so that the co-operation is broken when a local load of a predetermined size is applied in the transversal direction. The post is

characterized in that per se known internal grooves, which form lines of fracture, are provided in the corners of the casing, which is shaped as a polygonal member and manufactured by extruding, and open channels are arranged at least
5 on some sides of the casing, delimited by tongues protruding inwards, and the bars are suitably located in the channels, preferably being pretensioned. A base is provided for mounting the casing and the bars (claim 1).

Channels having tongues stand in static cooperation
10 with the bars. However, the bars have no through-going holes, and moreover, no reinforcement member is arranged in each bar (figs. 1 og 2).

A post as described in NO 160458 will work only as a HE mast. At a possible collision, it will not break, but rather
15 collapse. For this reason, a vehicle colliding with a mast as described in NO 160458 will not continue onwards, but be stopped by the mast. A post as it is described in NO 160458 will only work as a HE mast and be less suitable as a LE mast, in particular for purposes where shorter LE-masts are
20 required. If a mast according to NO 160458 is utilized for shorter masts, the consequences of a collision may firstly be that the mast can cause larger personal injuries than necessary, and secondly, that the mast may cause major and irreparable damages to the vehicle.

25 With this invention, a mast avoiding the above disadvantages, which will occur at a major, external impact on the mast, is provided. At a collision, the mast according to this invention will not break instantly, but first retain the vehicle and break thereafter, so that the vehicle will
30 continue onwards with a somewhat reduced velocity. How much the velocity (resistance) should be reduced before the mast breaks off, can be predetermined by different dimensioning of the mast according to the invention.

Summary of the invention

35 A mast for traffic information and/or lighting purposes, such as signposts, light signal posts, half and full gantries, street lighting posts or similar, has been deve-

loped. The mast comprises at least one mast profile and a fastening profile being joined in complimentary, mutual contacting surfaces by friction/retaining.

Novel and special features of the invention are that
5 one or more holes are formed in the cross section of each fastening profile, where each hole is adapted for arranging at least one longitudinal reinforcement member.

At present, no mast exists which complies with the requirements for acceptance in the LE category and/or HE
10 category. Tests according to EN 12767 of the mast according to this invention show that the requirements for acceptance in the LE category and HE category, depending on the length and dimensioning of the mast according to the invention.

The invention is not limited to traffic information
15 and/or lighting purposes, but can also be supporting structure for electric cables, telecommunication cables or similar.

The invention will be described below, with reference to the accompanying drawings.

20 Description of the drawings

Figure 1 shows principle and mode of operation for a NE mas
at a collision between a vehicle and the NE mast.

Figure 2 shows principle and mode of operation for a LE
mast / HE mast at a collision between a vehicle
25 and the LE mast / HE mast.

Figure 3 is a cross section of a fastening profile.

Figure 4 is a cross section of a fastening profile in
cooperation with a mast profile.

Figure 5 is an exploded view of an embodiment of the
30 invention.

Figure 6 shows a schematic section of a mast according to
the invention.

Figure 7 shows an embodiment of the invention where the
mast is a tubular mast.

35 Figure 8A shows schematically an embodiment of the invention
wherein cushioning members are arranged on each
reinforcement member.

Figure 8B shows schematically the embodiment of fig. 8A in detail.

Figure 9A shows an embodiment of the invention wherein two holes are formed in the cross section of a fastening profile.

Figure 9B is a cross section of an embodiment of a mast according to the invention wherein each mast profile on each side in the transversal direction is connected with a second mast profile by means of stiffening elements. For each mast profile, a fastening profile is arranged which is joined with the mast profile in complementary, mutual contacting surfaces.

Preferred embodiments

Now, figs. 3-5 are referred to. A cross section of a fastening profile 4 is shown. Figure 4 shows a fastening profile arranged in a mast profile 7, and figure 5 shows an exploded view of a mast according to the invention. The mast is particularly suitable for traffic information and/or lighting purposes, such as traffic signposts, light signal posts, full and half gantries, street lighting or similar.

At least one mast profile 7 and a fastening profile 4 are joined in complementary, mutual contacting surfaces on the mast profile 7 by friction/retaining. The mast profile 7 and the fastening profile 4 are adapted to stand proximate to each other with as large contacting surface as possible. In a normal state, the fastening profile 4 does not have any intended effect, but at a major mechanical impact on the mast, such as at a collision, a friction effect, or retaining, of the material will occur in the contact faces between the fastening profile 4 and the mast profile 7. This friction effect, or retaining, between each fastening profile 4 and the mast profile 7 leads to a locking effect between each fastening profile 4 mast profile 7 in the longitudinal direction. The friction effect is sought to be increased to a maximum by making the contacting surface between each fastening profile 4 and mast profile 7 as large as possible. In this manner, the number of bolts,

screws/nuts, pop rivets and similar fastening means in the structure are reduced to a minimum, and fastening means such as welding, glueing or similar are avoided. Problems which can arise with time with these fastening means are e.g. that the connection between the fastening profile 4 and the mast profile 7 may loosen, or pits may form due to the above screw connections. Reinstating contact between the mast profile 7 and the fastening profile is both cost and work intensive in these cases. With this invention, these problems are avoided.

One or more holes 4A are formed in the cross section of each fastening profile 4. One embodiment of the invention, in which a hole 4A is formed in the cross section of a fastening profile 4, is shown in figures 3 and 4, and a second embodiment of the invention, in which two holes 4A, 4B are formed in the cross section of a fastening profile 4, is shown in figures 9A og 9B. Moreover, more than two holes 4A, 4B may also be formed in the cross section of a fastening profile 4. Each hole 4A is adapted for the arrangement of at least one longitudinal reinforcement member 8.

A reinforcement member 8 can be arranged in one or more fastening profiles 4, generally for reinforcing the mast, e.g. as shown in figure 5. Each reinforcement member 8 is enclosed by at least parts of the fastening profile 4 and can be threaded in one end, in both ends, or along the complete member. In the case when the fastening profiles 4 extend along the complete mast, these are screwed into the ends of the mast.

The fastening profile 4 can in an additional embodiment extend along parts of the reinforcement member 4. In such an embodiment, the fastening profile 4 can extend from one end of the reinforcement member 8 to some distance along the reinforcement member 8. In such an embodiment, the length of the fastening profile 4 can be preferably 10-15 cm, but is not limited to this length.

Fastening profiles 4 having gripping members 5 are adapted for cooperating with corresponding gripping members 6 on mast profiles 7 being incorporated into the mast. The gripping members 5, 6 can extend along the complete length of

each fastening profile 4 and mast profile 7, but may also be formed along a part of the mast. The gripping members 5 of the fastening profile 4 are designed to fit to the gripping members 6 of the mast profile 7. In the embodiment in
5 figures 4 and 5, the gripping members 5 of the fastening profiles 4 are constructed with protruding locking list portions 5A, and intermediate locking grooves 5B are adapted for receiving locking list portions 6A on the mast profile
10 7. Corresponding intermediate locking grooves 6B on the mast profile 7 are adapted for receiving the protruding locking list portions 5A.

In a preferred embodiment, the fastening profile 4 extends to a length of 0,5 metre from one end of the mast, and in an additional preferred embodiment the fastening
15 profile extends to a length of 1 metre from one end of the mast.

In principle, any material can be utilized for the mast, but in a preferred embodiment, each fastening profile 4 and mast profile 5 are made of aluminium or an aluminium
20 alloy having desired properties, and the reinforcement element 8 is made of steel. This provides a light-weight and strong structure having the desired retaining or friction properties.

Each mast profile 7 with corresponding fastening
25 profile 4 can in one end be fastened to a base plate 2 with suitable fastening means, as illustrated in figure 5. The figure shows an exploded view of a mast installation according to the invention including a mast 1, a base plate 2 and a base 3.

30 The mast can in an embodiment of the invention comprise a number of extended mast profiles 7, wherein each mast profile 7 on each side in the transversal direction is connected with another mast profile by means of stiffening elements 9, so that a mast having at least two lateral surfaces
35 in which each mast profile 7 forms a corner between two stiffening elements 9. A mast of this kind can e.g. be a lattice mast. Figure 5 shows an embodiment of the invention in which the mast is a lattice mast. The reinforcement members 8 are threaded into the fastening profiles 4, which

in their turn are threaded into the mast profiles 7 of the mast. The fastening profiles 4, including reinforcement members 8, are fastened on the base plate 2.

Figure 6 shows a schematic section through a mast according to the invention, having fastening profiles 4 which are adapted for cooperation with mast profiles 7. In this embodiment, each fastening profile 4 extends along the complete length of the mast profile 7.

The invention can also be utilized for other kinds of masts, e.g. masts of the tubular type. Figure 7 shows a cross section through an additional mast embodiment of the invention, wherein the mast is a tubular mast.

For road safety purposes, the mast advantageously meets the requirements which are set in EN 12767 for LE-masts and HE-masts, as mentioned above. Each mast profile 7 and a fastening profile 4 are made of solid, light-weight and ductile materials in relation to the corresponding reinforcement member 8. In other words, the reinforcement member 8 can in a preferred embodiment of the invention be made of a material having a higher mechanical strength and stiffness than the material in the mast profile 7 and the fastening profile 4. These properties involve that the mast will not break instantly at a major, external impact.

Each fastening profile 4 can advantageously be shaped so that the cross sectional area of the fastening profile 7 is reduced as much as possible, while maintaining maximal friction surface between the fastening profile 4 and the mast profile 7. An example of such a fastening profile 4 is shown in figure 9A, wherein the fastening profile 4 is constructed with a hole 4A adapted for arrangement of a reinforcement member 8, and a hole 4B for the purpose of reducing the cross section of the fastening profile 4. Such a shape will lead to reduced material consumption, while maintaining maximal contacting surface between the fastening profile 4 and the mast profile 7.

In a further embodiment of the invention, each reinforcement member 8 can be adapted for arrangement of at least one cushioning member 10. Several materials can be suitable for such cushioning members, e.g., rubber or

another suitable material. An example of a mast according to the invention having such cushioning members 10 is shown in fig. 8A. Details of this embodiment are shown in fig. 8B.

5 Dimensioning of the mast and choice of material are factors which can decide whether the mast meet the criterias for LE masts and/or HE masts. HE masts can e.g., if desired, be utilized for stopping a vehicle as soon as possible, preferably in the case of high lighting masts.

10 The mode of operation for the mast in the case of a major mechanical impact, such as by collision of a vehicle, will be as follows: In the normal state, the fastening profile 4 has no intended effect, but at a major mechanical impact on the mast, such as at a collision, the mast and the fastening profile 4 will bend about each other so that a
15 friction, or retaining, effect of the material in the contacting surfaces between the fastening profile 4 and the mast profile 7. The fastening profile 4 then becomes effective and fixes the mast to the base plate 2 by means of suitable fastening means. The force by which the fastening
20 profile 4 fixes the mast to the base primarily depends on the dimensioning of the reinforcement member(s) 8. Depending on the kind of mast (LE mast or HE mast) to be utilized, the behaviour of the mast will be as explained in the introductory part of the description and as shown in figures 2A and
25 2B for LE-mast and HE-mast.

C l a i m s

1. Mast for traffic information and/or lighting purposes, such as traffic signposts, light signal posts, full and half gantries, street lighting and/or lighting purposes, in which the mast comprises at least one mast profile (7) and a fastening profile (4) being joined in complementary, mutual contacting surfaces on the mast profile (7) by frictional connection / retaining,
c h a r a c t e r i z e d i n that one or more holes (4A,4B) are formed in the cross section of each fastening profile (4), wherein at least one hole (4A) is adapted for arrangement of at least one longitudinal reinforcement member (8).
2. Mast according to claim 1,
c h a r a c t e r i z e d i n that the reinforcement member (8) is made of a material having a higher mechanical strength than the material in the mast profile (7) and the fastening profile (4).
3. Mast according to claim 1 or 2,
c h a r a c t e r i z e d i n that the complementary, mutual contacting surfaces are constituted of gripping members (5A,5B) being adapted for being in mesh with corresponding gripping members (6A,6B) in each mast profile (7).
4. Mast according to claim 3,
c h a r a c t e r i z e d i n that the gripping members (5A,5B, 6A,6B) extend along the full length of each fastening profile (4) and mast profile (7).
5. Mast according to anyone of the preceding claims,
c h a r a c t e r i z e d i n that the fastening profile (4) extends only along parts of the reinforcement member (8).

6. Mast according to anyone of the preceding claims, characterized in that it is deformable by means of mechanical impacts.
7. Mast according to anyone of the preceding claims, characterized in that each mast profile (7) with corresponding fastening profile (4) is made of aluminium, an aluminium alloy or similar, and that each reinforcement member (8) is made of steel.
8. Mast according to anyone of the following claims, characterized in that it comprises one or more extended mast profiles, wherein each mast profile (7) is connected with another mast profile by means of stiffening elements (9), so that a mast having at least two lateral sides are formed, in which each mast profile (7) forms a corner between two stiffening elements (9).
9. Mast according to claim 8, characterized in that it is a lattice mast.
10. Mast according to anyone of the claims 1-8, characterized in that it is a tubular mast.
11. Mast according to anyone of the preceding claims, characterized in that each mast profile (7) with corresponding fastening profile (4) in one end is fixed to a base with suitable fastening means.
12. Mast according to anyone of the preceding claims, characterized in that each reinforcement member (8) is adapted for arrangement of at least one cushioning member (10).

FIG. 1

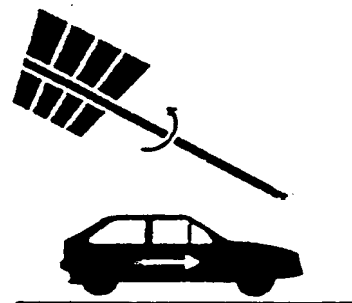
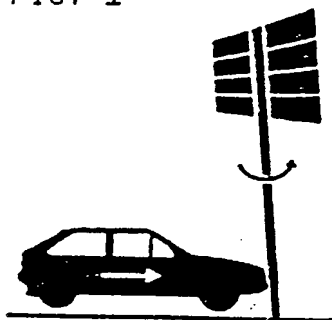


FIG. 2A

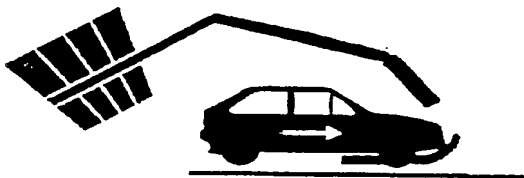
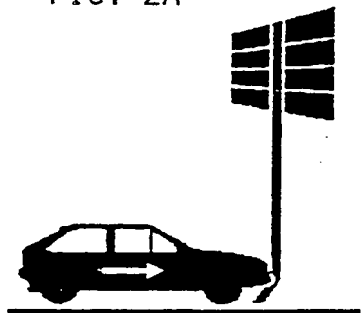
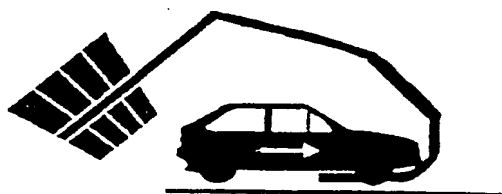
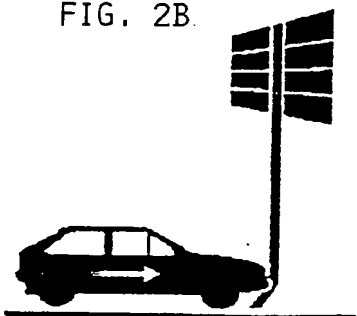


FIG. 2B



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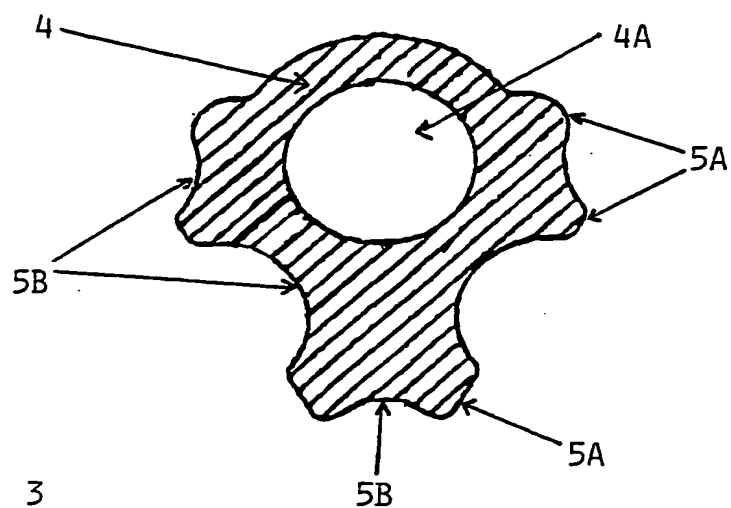


FIG. 3

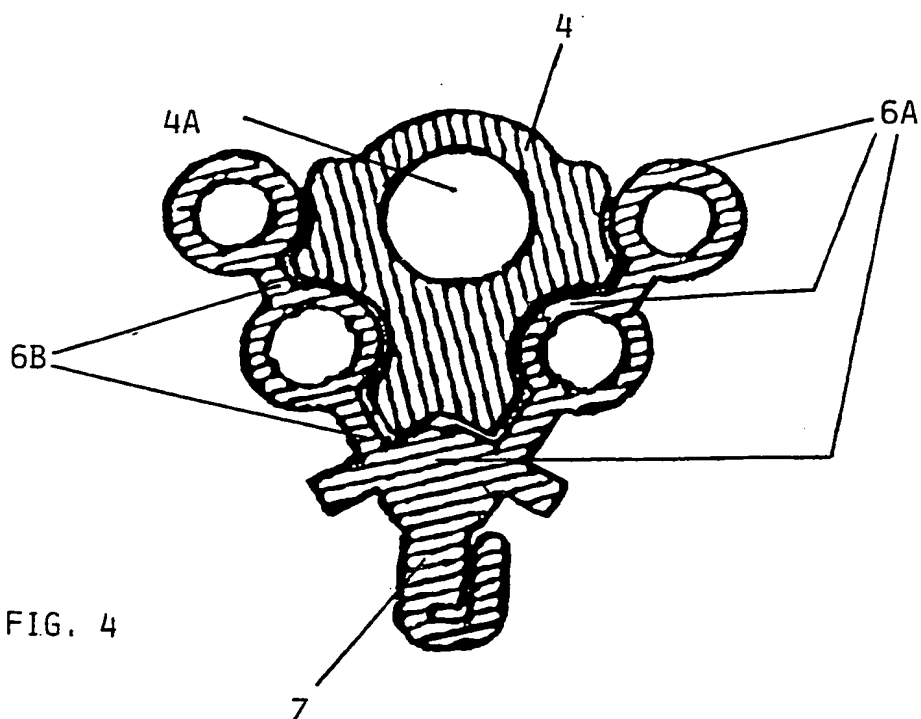


FIG. 4

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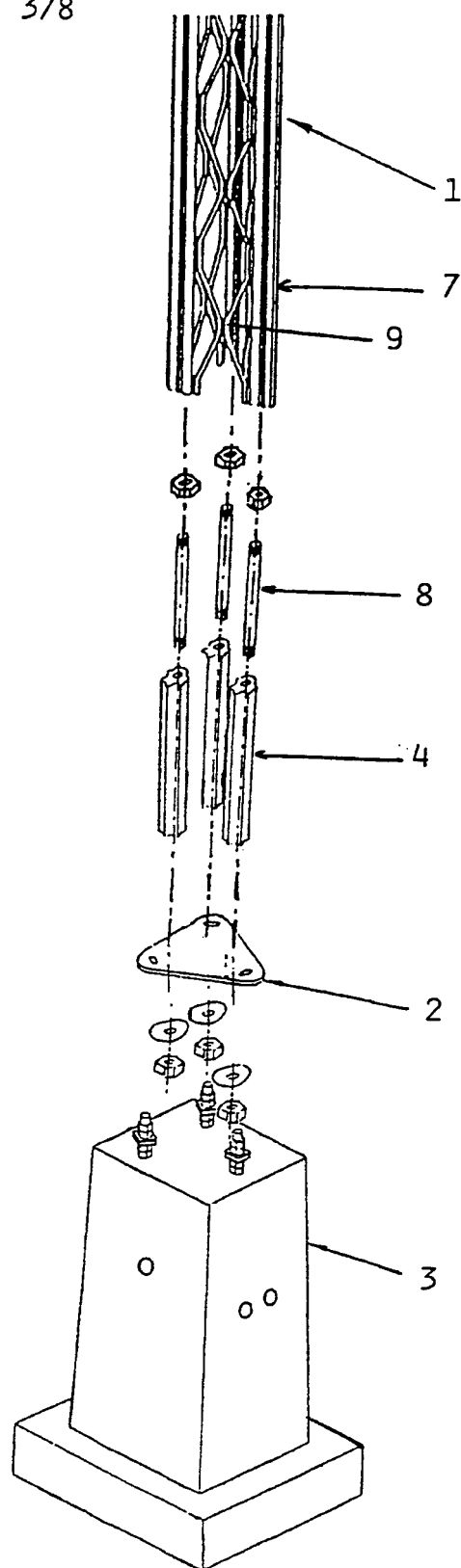
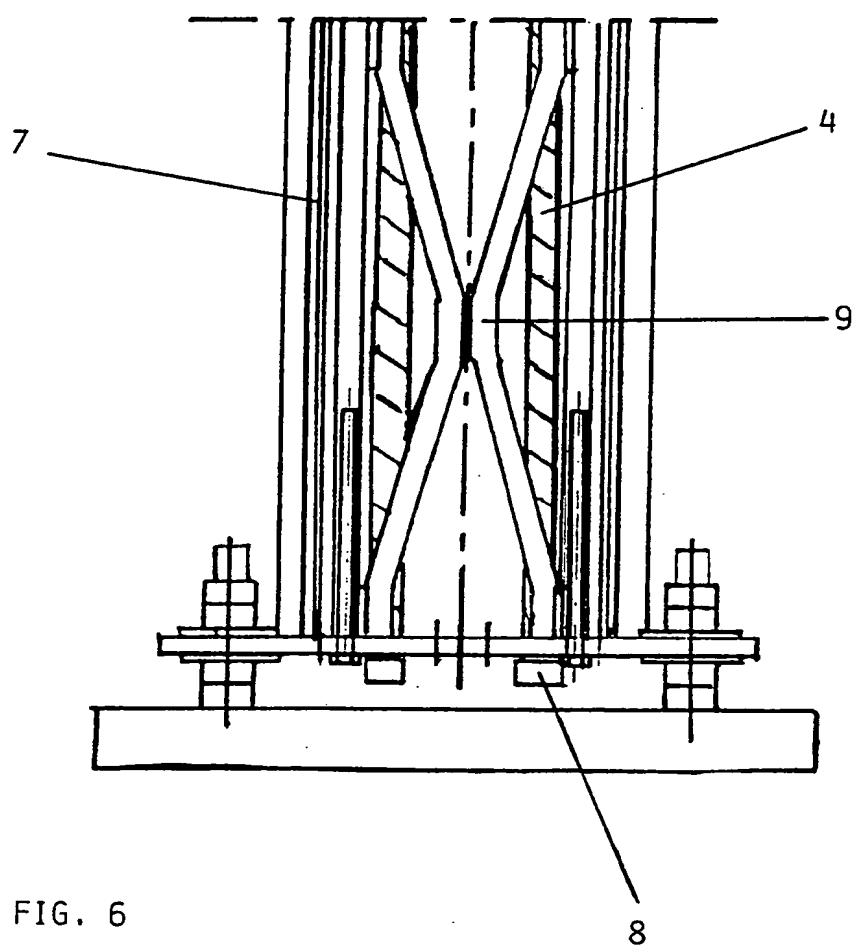


FIG. 5



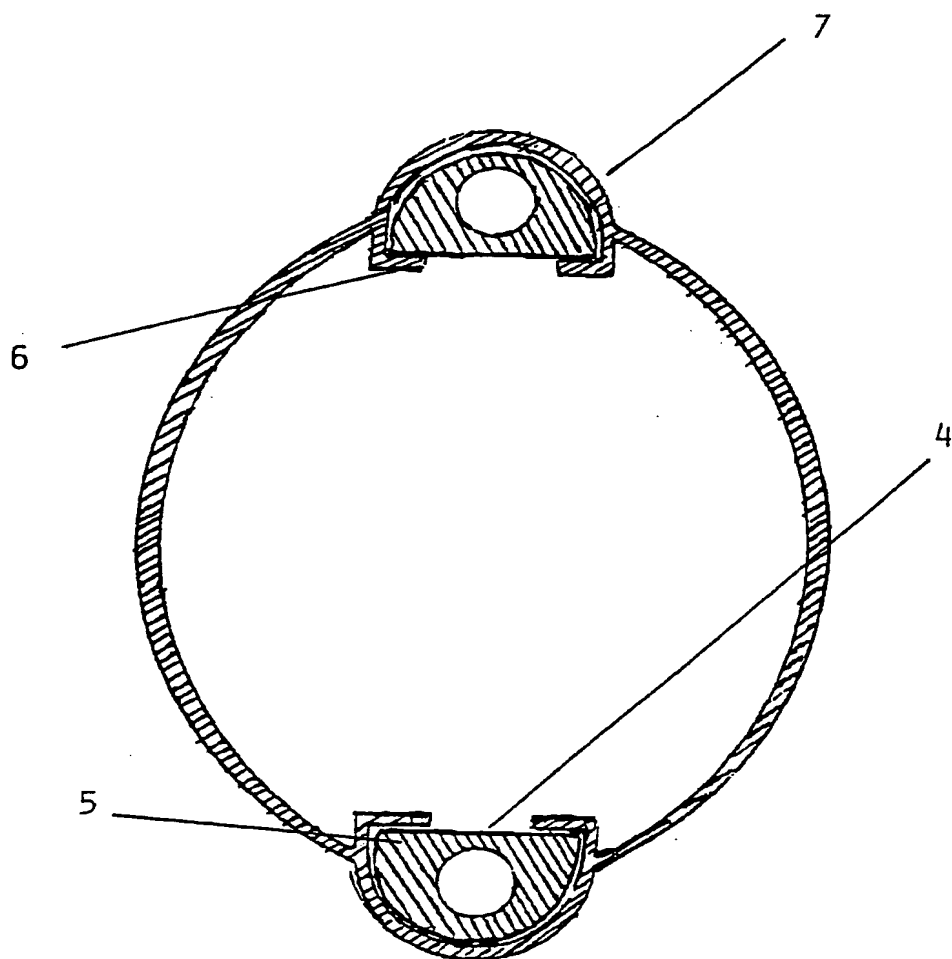


FIG. 7

FIG. 8A

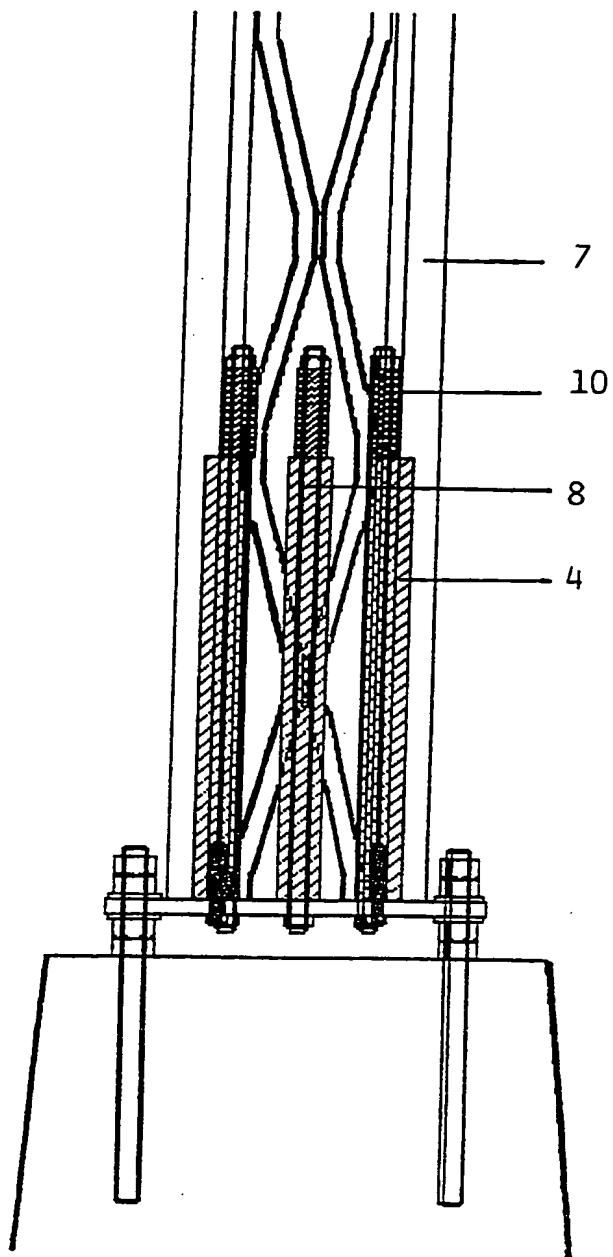


FIG. 8B

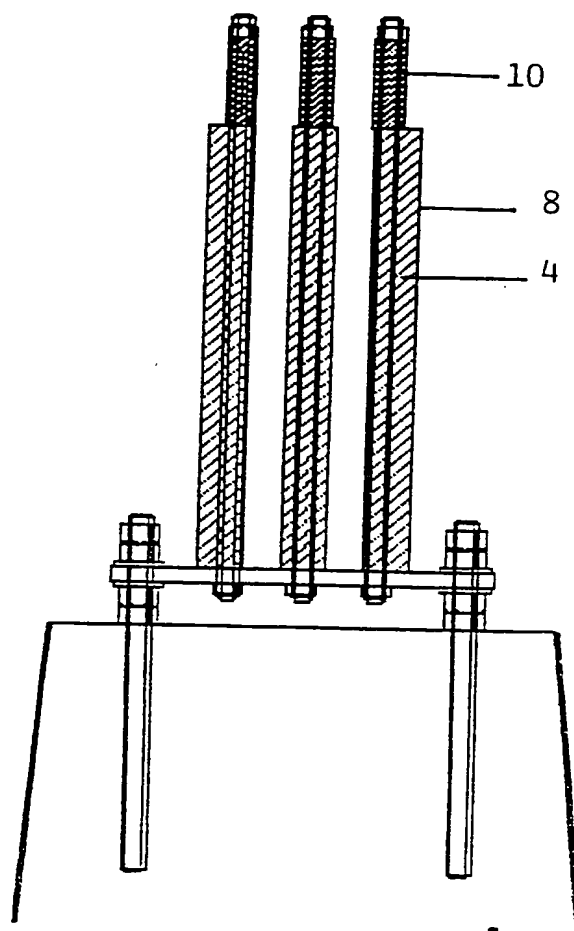


FIG. 9A

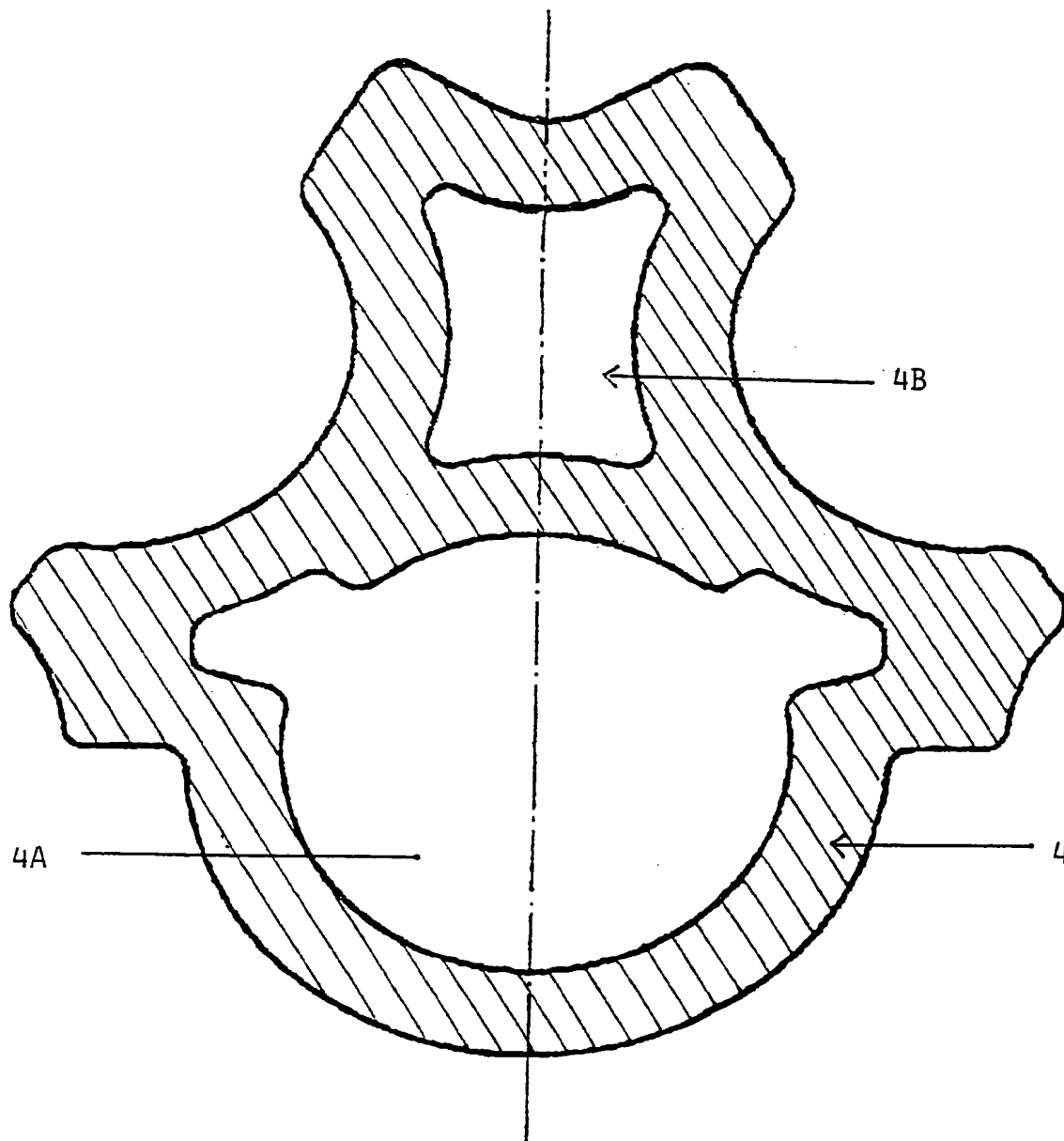
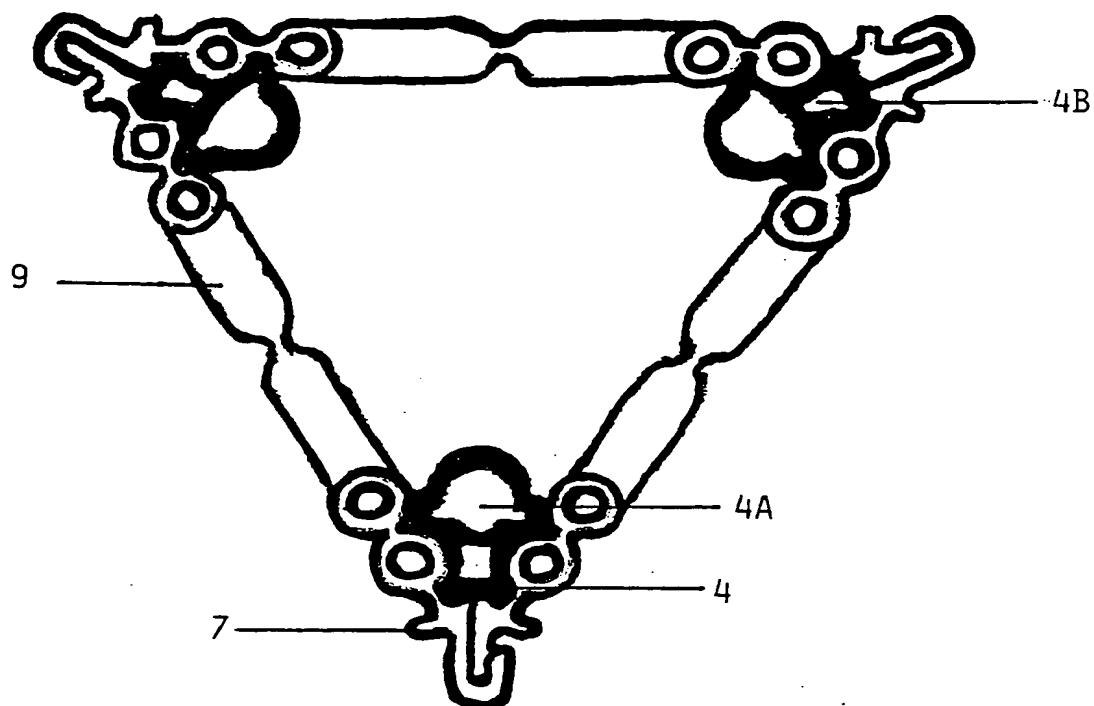


FIG. 9B



INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 00/00381

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: E01F 9/018

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: E04C, E01F, E04H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	NO 160458 B (LARS SVENSSON), 9 January 1989 (09.01.89), whole document --	1-12
X	DE 2341185 A (SVENSSON, LARS), 7 March 1974 (07.03.74), whole document --	1-12
X	US 4793111 A (SHEWCHUK), 27 December 1988 (27.12.88), whole document --	1-12
A	EP 0389214 A2 (OWEN BROWN GROUP LTD), 26 Sept 1990 (26.09.90), whole document --	1-12

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

5 March 2001

Date of mailing of the international search report

08-03-2001

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INTERNATIONAL SEARCH REPORT

International application No.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

05/02/01

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